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Diagnosis and Management of Community-acquired Pneumonia
An Official American Thoracic Society Clinical Practice Guideline

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Abstract

Background: Understanding of the diagnosis and treatment of adults with community-acquired pneumonia (CAP) has evolved thanks to new evidence, experience, and emerging technologies. This document updates evidence-based clinical practice guidelines on four key questions for the diagnosis and management of adult patients with CAP.

Methods: A multidisciplinary panel integrated systematic reviews of comparative evidence with other relevant research and clinical experience, then applied Grading of Recommendations, Assessment, Development and Evaluation methodology to produce recommendations using the Evidence to Decision Framework.

Results: The panel formulated clinical recommendations that address questions related to CAP, including lung ultrasound for diagnosis, empiric antibacterial therapy if a test result for a respiratory virus is positive, antibiotic duration, and the use of systemic corticosteroids.

Conclusions: The panel formulated and provided the rationale for recommendations on selected diagnostic and treatment strategies for adult patients with CAP.

Keywords: pneumonia; lower respiratory tract infection; practice guidelines; guideline update

Summary of Recommendations

1. Lung ultrasound versus chest radiography to diagnose CAP
For adults with suspected CAP, we suggest lung ultrasound is an acceptable diagnostic alternative to chest radiography in medical centers where appropriate clinical expertise exists (conditional recommendation, low-quality evidence). Vote: 13 (87%) of 15 committee members voted in favor of this recommendation.
2. Empiric antibacterial therapy for CAP with positive respiratory virus testing
For adult outpatients without comorbidities who have clinical and

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imaging evidence of CAP and who have a positive test result for a respiratory virus, we suggest not prescribing empiric antibiotics (conditional recommendation, very low-quality evidence). Remark: This is a conditional recommendation because the balance between benefit and harm of empiric antibiotics will vary on the basis of clinical context (*see* Table 1). Vote: 14 (93%) of 15 committee members voted in favor of not prescribing antibiotics.

For adult outpatients with comorbidities who have clinical and imaging evidence of CAP and who have a positive test result for a respiratory virus, we suggest prescribing empiric antibiotics because of concern for bacterial-viral coinfection (conditional recommendation, very low-quality evidence). Remark: This is a conditional recommendation because the balance between benefit and harm of empiric antibiotics will vary on the basis of clinical context (*see* Table 1). Vote: 11 (73%) of 15 committee members voted in favor of prescribing antibiotics.

For adult inpatients with clinical and imaging evidence of nonsevere CAP who have a positive test result for a respiratory virus, we suggest prescribing empiric antibiotics because of concern for bacterial-viral coinfection (conditional recommendation, very low-quality evidence). Remark: This is a conditional recommendation because the balance between benefit and harm of empiric antibiotics will vary on the basis of clinical context (Table 1). Vote: 12 (80%) of 15 committee members voted in favor of prescribing antibiotics.

For adult inpatients with clinical and imaging evidence of severe CAP who have a positive test result for a respiratory virus, we suggest prescribing empiric antibiotics because of concern for bacterial-viral coinfection (conditional recommendation, very low-quality evidence). Remark: Although the committee was unanimous in making this recommendation, this is a conditional recommendation because of the absence of comparative evidence. Vote: 15 (100%) of 15 committee members voted in favor of prescribing antibiotics.

3. Antibiotic duration for CAP

For adult outpatients with CAP who reach clinical stability, we suggest less than 5 days of antibiotics (minimum of 3-d duration) rather than 5 or more days of antibiotics (conditional recommendation, low-quality evidence). Remark: This is a conditional recommendation that requires individualization. *See* Table 1 for factors that weaken this recommendation. Vote: 15 (94%) of 16 committee members voted in favor of less than 5 days of antibiotics.

For adult inpatients with nonsevere CAP who reach clinical stability, we suggest less than 5 days of antibiotics (minimum of 3-d duration) rather than 5 or more days of antibiotics (conditional recommendation, low-quality evidence). Remark: This is a conditional recommendation that requires individualization. *See* Table 1 for factors that weaken this recommendation. Vote: 11 (69%) of 16 committee members voted in favor of less than 5 days of antibiotics.

For adult inpatients with severe CAP who reach clinical stability, we suggest 5 or more days of antibiotics rather than less than 5 days of antibiotics (strong recommendation, low-quality evidence). Remark: This recommendation is strong despite the low-quality of evidence because insufficient antibiotic therapy can result in serious adverse outcomes or death in patients with severe CAP. Vote: 15 (94%) of 16 committee members voted in favor of 5 or more days of antibiotics.

4. Systemic corticosteroids for CAP

For adult inpatients with nonsevere CAP, we recommend NOT administering systemic corticosteroids (strong recommendation, low-quality evidence). Remark: This recommendation is strong because, although the overall quality of evidence was low, the intent is to avoid harmful side effects such as hyperglycemia for which there is robust evidence. Vote: 16 (100%) of 16 committee members voted in favor not administering systemic corticosteroids.

For adult inpatients with severe CAP, we suggest systemic corticosteroids (conditional recommendation, low-quality evidence). Remark: This recommendation excludes patients with severe CAP caused by influenza pneumonia. Vote: 15 (94%) of 16 committee members voted in favor systemic corticosteroids.

Introduction

In 2019, the American Thoracic Society (ATS) and the Infectious Diseases Society of America (IDSA) provided evidence-based

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Table 1. Individual Patient Factors to Consider that May Strengthen or Weaken Recommendations

Recommendation	Strength and Evidence Quality	Factors that Strengthen the Recommendation	Factors that Weaken the Recommendation
1. Lung ultrasound versus chest radiography to diagnose CAP			
For adults with suspected CAP, we suggest LUS is an acceptable diagnostic alternative to chest radiography in medical centers where appropriate clinical expertise exists.	Conditional Low-quality evidence 94% consensus	All criteria for establishing expertise met (Table 4) No availability of chest radiography (LUS as alternative to radiography) High patient risks or cost of CT scan (LUS as alternative to CT) Patient convenience and radiation exposure compared with chest radiography and CT	Not all criteria for establishing expertise met (Table 4) Suspicion of alternative/additional diagnoses (pulmonary embolism, malignancy) Barriers to high-quality LUS (obesity, drains, scars, wounds, difficulty holding position)
2. Empiric antibacterial therapy for CAP with positive respiratory virus testing			
For adult outpatients without comorbidities who have clinical and imaging evidence of CAP and who have positive test result for a respiratory virus, we suggest not prescribing empiric antibiotics.	Conditional Very low-quality evidence 93% consensus	Low suspicion for bacterial coinfection (clinical history, low/normal inflammatory markers, clinical history, radiologic findings suggestive of viral etiology, viral pathogen with low prevalence of bacterial codetection) Higher risk of harm from antibiotic exposure (history of *Clostridioides difficile*, severe antibiotic allergy or adverse event) Patient preference to avoid antibiotic exposure	Suspicion of bacterial coinfection (long symptom onset, "double sickening," purulent sputum, elevated inflammatory markers, radiologic findings such as consolidative infiltrate, viral pathogen with high prevalence of bacterial codetection, exposure to *Mycoplasma pneumoniae*) High risk of harm if missed bacterial infection (elderly, pregnant, signs/symptoms suggestive of more severe illness) Barriers to follow-up or communication
For adult outpatients with comorbidities who have clinical and imaging evidence of CAP and who have positive test result for a respiratory virus, we suggest prescribing empiric antibiotics because of concern for bacterial-viral coinfection.	Conditional Very low-quality evidence 73% consensus	Suspicion of bacterial coinfection (long symptom onset, "double sickening," purulent sputum, elevated or increasing inflammatory markers, radiologic findings such as consolidative infiltrate) Low likelihood that virus identified explains etiology and severity of pneumonia (i.e., virus with low virulence or high risk of coinfection) High risk of harm if missed bacterial infection High illness severity, severe symptoms Higher number, severe, or poorly controlled comorbidities	Low suspicion of bacterial infection (clinical history, normal inflammatory markers, radiologic findings suggestive of viral etiology) High likelihood that virus identified explains etiology and severity of pneumonia (virus with high virulence, low risk of coinfection) Lower risk of harm if missed bacterial infection Lower illness severity Single, mild, or well-controlled comorbidities Higher risk of harm from antibiotic exposure (History of *C. difficile,* antibiotic allergy/adverse event) Patient preference to avoid antibiotic exposure
For adult inpatients with clinical and imaging evidence of nonsevere CAP who have positive test result for a respiratory virus, we suggest prescribing empiric antibiotics because of concern for bacterial-viral coinfection.	Conditional Very low-quality evidence 80% consensus	Same as above	Same as above
For adult inpatients with clinical and imaging evidence of severe CAP who have positive test result for a respiratory virus, we suggest prescribing antibiotics because of concern for bacterial-viral coinfection	Conditional Very low-quality evidence 100% consensus	Sepsis, severe respiratory failure, elevated or increasing inflammatory markers Chest radiograph showing consolidation infiltrates	Higher risk of harm from antibiotic exposure (history of *C. difficile*, antibiotic allergy, or antibiotic adverse event)

(*Continued*)

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Table 1. (*Continued*)

Recommendation	Strength and Evidence Quality	Factors that Strengthen the Recommendation	Factors that Weaken the Recommendation
3. Antibiotic duration for CAP			
For adult outpatients with CAP who reach clinical stability*, we suggest less than 5 days of antibiotics (minimum of 3-d duration) rather than 5 or more days of antibiotics.	Conditional Low-quality evidence 94% consensus	Higher risk of harm from prolonged antibiotic exposure (history of *C. difficile* or an antibiotic adverse event) Patient preference to minimize antibiotic exposure	Barriers to self-assessment, follow-up, or communication to ensure recovery Organism requiring longer duration (i.e., *Staphylococcus aureus*, *Pseudomonas aeruginosa*, suspected *Legionella pneumophila* or other intracellular microorganisms)† Radiographic findings (high burden of disease, necrotizing process, dense consolidations) Underlying lung disease (e.g., bronchiectasis, postobstructive pneumonia, chronic respiratory insufficiency†) Recent hospitalization or resident in long-term care facility†
For adult inpatients with nonsevere CAP who reach clinical stability*, we suggest less than 5 days of antibiotics (minimum of 3-d duration) rather than 5 or more days of antibiotics.	Conditional Low-quality evidence 69% consensus	Patient preference to minimize antibiotic exposure Resolution of inflammatory markers	Organism requiring longer duration (i.e., *Staphylococcus aureus*, *Pseudomonas aeruginosa*, suspected *Legionella pneumophila* or other intracellular microorganisms)† Pneumonia complication (e.g., empyema/parapneumonic effusion, abscess/necrotizing process, bacteremia, extrapulmonary infection) Underlying lung disease (e.g., bronchiectasis, postobstructive pneumonia, chronic hypoxemia†) Pregnancy, recent antibiotics† Recent hospitalization or resident in long-term care facility†
For adult inpatients with severe CAP who reach clinical stability, we suggest 5 or more days of antibiotics rather than less than 5 days of antibiotics.	Strong Low-quality evidence 100% consensus	—	—
4. Corticosteroids			
For adult inpatients with nonsevere CAP, we recommend NOT administering systemic corticosteroids‡	Strong Low-quality evidence 100% consensus	—	—
For adult inpatients with severe CAP, we suggest systemic corticosteroids.	Conditional Low-quality evidence 94% consensus	Short time interval between symptom onset and presentation Ability to administer corticosteroids early after meeting criteria for severe CAP (within 24 h) ICU admitted Respiratory failure (Pa_{O_2}/FI_{O_2} ratio <300) Elevated inflammatory markers (i.e., CRP, IL-6)	Longer time between symptom onset and presentation Longer time since onset of severe CAP (e.g., >72 h) Lack of respiratory failure Normal or low inflammatory markers Contraindications to corticosteroids (i.e., influenza, *Aspergillus*, uncontrolled diabetes, recent gastrointestinal bleeding) Pregnancy†

Definition of abbreviations: CAP = community-acquired pneumonia; CRP = C-reactive protein; CT = computed tomography; LUS = lung ultrasound.
Factors listed in this table were generated from clinical experience, observational studies, and pathophysiologic rationale but are not supported by high-quality comparative evidence and should be integrated with clinical judgment for individual patient care. Recommendations are not for patients with immunocompromise. See other guidelines focused on this patient population.
*The duration of antibiotics should be determined on the basis of daily assessment of clinical stability.
†Exclusion criteria from key studies.
‡Recommendation and factors listed are for patients without another established indication of corticosteroids.

practice guidelines on the management of adult patients with community-acquired pneumonia (CAP) to provide an update to the previous 2007 guideline (1, 2). It addressed 16 specific areas for recommendations surrounding diagnostic testing, determination of site of care, selection of empiric antibiotic therapy, and subsequent management decisions. Since publication of the 2019 guidelines, the care of CAP has been impacted by the COVID-19 pandemic and the availability of rapid molecular tests for multiple pathogens, including viruses, emerging imaging technology, and new evidence surrounding the host response and the potential role of corticosteroids. Given the dynamic nature of the evidence base for CAP and the need for more rapidly updated guidance, there has been a move toward more rapidly generated incremental guideline recommendation updates. The first of these updates addressed nucleic acid testing for noninfluenza and non–SARS-CoV-2 viruses (3). The present update addresses four clinically relevant questions, of which two are updates from the 2019 guideline and two are new questions:

1. Should lung ultrasound be considered a reasonable alternative to chest radiography for diagnosis in adults with suspected community-acquired pneumonia? (New)
2. Should adults with community-acquired pneumonia who have a positive test result for a respiratory virus be treated with empiric antibacterial therapy? (New)
3. Should adults with community-acquired pneumonia who reach clinical stability be treated with less than 5 days of antibiotics? (Update from 2019)
4. Should adults who are hospitalized with community-acquired pneumonia be treated with corticosteroids? (Update from 2019)

This guideline update addresses CAP in immunocompetent adult patients. Pneumonia is a lower respiratory tract infection (LRTI) that causes inflammation in the alveoli. CAP is acquired outside of hospital or healthcare settings, and most commonly patients present to the emergency department or primary care. Because CAP cannot be clinically distinguished from other LRTIs without chest imaging to confirm alveolar inflammation, the standard diagnosis of CAP requires clinical signs and symptoms plus chest imaging confirmation to visualize alveolar inflammation. This guideline update focuses only on those patients with a standard diagnosis of CAP.

CAP can be caused by bacterial, viral, or fungal pathogens or a combination of pathogens. The diagnosis does not require microbiologic confirmation, because microbiologic tests have poor sensitivity. This definition includes all viruses, including SARS-CoV-2. However, this guideline update does not address the syndrome of SARS-CoV-2 pneumonia that was seen during the COVID-19 pandemic. Patients who presented with pneumonia caused by SARS-CoV-2 during the COVID-19 pandemic exhibited distinct patterns of presentation and responses to therapies because of its novelty, virulence, dominance over other pathogens, and naivety of the host immune system. Evidence and guidelines were generated to support management (4, 5) that are distinct from this guideline and do not apply to CAP. With the exception of the lung ultrasound (LUS) question, none of the other formal evidence reviews included studies conducted during the pandemic. As we emerge from the pandemic and SARS-CoV-2 becomes integrated into the milieu of respiratory pathogens that cause CAP, we expect the pattern of presentation, epidemiology, and responsiveness to therapy for patients with CAP caused by SARS-CoV-2 to change. At the time of this publication, it is not clear whether today's patient with pneumonia caused by SARS-CoV-2 would most benefit from standard CAP management or COVID-19 treatments used during the pandemic.

This guideline update is also not intended for use in immunocompromised hosts (ICHs). Patients classified as ICHs have compromised immune systems because of certain medical conditions, including malignancy, advanced HIV infection, and organ transplant, and treatments that impair the immune system, including chronic glucocorticoids, chemotherapy, conventional disease-modifying antirheumatic drugs, and biological agents used to treat various rheumatologic, dermatologic, gastrointestinal, and autoimmune disorders. The clinical presentation, pathogen profile, and host responses to pneumonia in ICHs are markedly different from those in nonimmunocompromised individuals. For detailed guidance on the diagnosis and management of pneumonia in ICHs, please consult specific recommendations provided by the ATS and other medical organizations (6, 7).

The understanding of CAP is evolving. Previously considered a sterile compartment, the lung is now understood as an active ecosystem with organisms that interact with each other and host cells in complex, dynamic ways (8). Pneumonia is no longer considered a simple matter of invasion of a sterile space by a foreign organism with the simple solution of eliminating offending pathogens. Rather, it is a state that emerges from structural and functional host susceptibility, dysbiosis (an imbalance in microbial populations), inflammation from a dysregulated host response, and tissue damage (9). This evolving understanding of the microbiology and host response of CAP has important implications for clinical management, particularly surrounding the optimal use of diagnostic tests, antimicrobials, and host modulating therapies. As a result, clinicians need to pursue more individualized, tailored approaches to clinical management.

We have maintained the convention of separate recommendations based on setting and severity of illness similar to prior ATS/IDSA guidelines: outpatients, inpatients with nonsevere CAP, and inpatients with severe CAP as defined by previously validated criteria (Table 2). However, decisions about site of care may be based on considerations other than severity and can vary widely between hospitals and practice sites. These guidelines are intended not to impose a standard of care based on singular categories but to provide the basis for rational decisions in the management of patients with CAP. The majority of the recommendations in this guideline update are conditional, meaning that a sizable minority of patients may not want the suggested course of action, and clinicians must help patients arrive at a management decision consistent with their values and preferences (Table 3). For each guideline recommendation, the committee generated patient factors to consider that strengthen or weaken the recommendation (Table 1). Clinicians should review these factors and individualize recommendations on the basis of their assessment of how well the guidelines apply to their patient. Clinicians, patients, third-party payers, institutional review committees, other stakeholders, and courts should never view or use these

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Table 2. 2007 and 2019 Infectious Diseases Society of America/American Thoracic Society Criteria for Defining Severe Community-acquired Pneumonia

Validated definition includes either one major criterion or three or more minor criteria
Major criteria
Septic shock with need for vasopressors
Respiratory failure requiring mechanical ventilation
Minor criteria
Respiratory rate ⩾30 breaths/min
$Pa_{O_2}/F_{I_{O_2}}$ ratio ⩽250
Multilobar infiltrates
Confusion/disorientation
Uremia (blood urea nitrogen concentration, ⩾20 mg/dl)
Leukopenia (white blood cell count, <4,000 cells/μl)
Thrombocytopenia (platelet count, <100,000/μl)
Hypothermia (core temperature, <36°C)
Hypotension requiring aggressive fluid resuscitation

recommendations as mandates. No guideline or recommendation can account for all the unique individual clinical circumstances that must be considered in medical decision making. Therefore, no one responsible for evaluating clinicians' actions should attempt to apply the recommendations from these guidelines by rote or in a blanket fashion. Statements about underlying values and preferences, as well as qualifying remarks, accompanying each recommendation are integral parts that serve to facilitate nuanced interpretation. They should never be omitted when quoting or translating recommendations from these guidelines.

Methods

A multidisciplinary (pulmonology, infectious disease, internal medicine, critical care, hospital medicine, emergency medicine, and evidence synthesis) panel of nine experts from the ATS and nine from the IDSA was composed to identify clinically important interventions for CAP that warrant review of the evidence. In accordance with Institute of Medicine (now the National Academy of Medicine) standards, clinical questions were posed, and systematic reviews of comparative effectiveness studies published between January 1, 1946, and March 31, 2023, were performed by four members of the methodology team to inform recommendations (10, 11). The literature search was updated on November 27, 2024, and February 20, 2025, with an additional 60 articles reviewed by the methodology team and cochairs. No studies were identified that required insertion into the completed systematic reviews. When the comparative evidence alone was deemed insufficient to inform a recommendation, it was supplemented with epidemiological evidence, clinical observations, and disease pathophysiology. The Grading of Recommendations, Assessment, Development and Evaluation approach was employed to formulate and rate the recommendations (12). The Convergence of Opinion on Recommendations and Evidence process was used to help generate consensus (13). To integrate patient feedback, the document was reviewed independently by two patient representatives (M.P. and C.H.), who were identified and recruited by committee members through nontherapeutic relationships for their experiences with having CAP. Each patient representative provided feedback surrounding each recommendation via a virtual meeting facilitated by the ATS senior director of documents and patient education, Judy Corn. Targeted questions for each recommendation prepared by cochairs were also answered. Feedback was then incorporated throughout the document by chairs and patient representatives and summarized in the patient input statement.

The guideline underwent anonymous peer review by 15 content experts (4 from the ATS and 11 from the IDSA). Following multiple cycles of review and revision, the guideline was reviewed and approved by a multidisciplinary board of directors from the ATS. However, it was not approved by the IDSA. The guideline update will be reviewed by the ATS 3 years after publication, and it will be determined if updating is necessary.

Table 3. Strength of Recommendations

	Strong Recommendation ("We recommend . . .")	Conditional Recommendation ("We suggest . . .")
For patients	The overwhelming majority of individuals in this situation would want the recommended course of action, and only a small minority would not.	The majority individuals in this situation would want the suggested course of action, but a sizable minority would not.
For clinicians	The overwhelming majority of individuals should receive the recommended course of action. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator. Formal decision aids are not likely to be needed to help individuals make decisions consistent with patient values and preferences.	Different choices will be appropriate for different patients, and you must help each patient arrive at a management decision consistent with her or his values and preferences. Decision aids may be useful to help individuals make decisions consistent with their values and preferences. Clinicians should expect to spend more time with patients when working toward a decision.
For policy makers	The recommendation can be adapted as policy in most situations, including for use as performance indicators if supported by high- or moderate-quality evidence.	Policy making will require substantial debates and involvement of many stakeholders. Policies are also more likely to vary between regions. Performance indicators would have to focus on the fact that adequate deliberation about the management options has taken place.

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A detailed description of the methods is provided in the online supplement. Implications of the strengths of the recommendations (i.e., strong vs. conditional) are described in Table 3.

Question 1: Should Lung Ultrasound Be Considered a Reasonable Diagnostic Alternative to Chest Radiography in Adults with Suspected Community-acquired Pneumonia?

Rationale. The diagnosis of pneumonia carries substantial uncertainty (14). Because signs and symptoms are neither sensitive nor specific, it is essential to confirm the clinical suspicion of pneumonia with visualization of alveolar inflammation on imaging. Confirming pneumonia through chest imaging is thus a standard in settings in which it is available, because the remainder of evidence-based practice hinges on diagnosis.

Chest radiography, which is the most common way of documenting a diagnosis, is less accurate than chest computed tomography (CT). However, chest CT is more costly and time-consuming. Both of these modalities require a radiology department. An estimated two-thirds of the world's population has limited or no access to radiographic imaging (15), and past clinical trials on pneumonia have been limited to use of chest radiography or CT (16, 17), effectively excluding much of the world from clinical research, the evidence base, and high-quality diagnosis.

Since the 1990s, studies of LUS have shown that this technique can accurately detect common lung pathologies when performed by clinicians competent in its use (16, 17). In recent years, more clinicians have begun using LUS to diagnose and manage patients with pulmonary disease thanks to advancements in ultrasound (US) technology, increased availability of portable US machines, and integration of training in LUS in undergraduate and graduate medical education (18, 19). Although our historical standard of diagnosis in CAP has been chest radiography (radiography or CT), there are currently few studies and guideline recommendations in this area. Because of the emerging evidence and availability of LUS, we pursued a review of the evidence surrounding LUS for the diagnosis of CAP.

Evidence synthesis. The guideline committee *a priori* defined three outcomes as "critical": *1*) time to appropriate diagnosis, treatment, and disposition; *2*) repeat visits to emergency department, clinic, or hospital; and *3*) test accuracy. The committee also *a priori* defined four outcomes as "important": use of advanced imaging, cost, and provider and patient experience (i.e., satisfaction).

We identified no studies that measured any outcomes besides accuracy when comparing LUS with chest radiography in patients with suspected CAP. No studies directly compared the effects of LUS and chest radiography on clinical outcomes in patients with suspicion for CAP. However, 12 studies of patients who underwent LUS and chest radiography and then proceeded to chest CT for clinical reasons (including discordance between LUS and radiography) were identified, which examined the test characteristics of LUS and chest radiography using chest CT as the reference standard (20–31) (*see* Table E1 in the online supplement). These studies provided indirect evidence, because they included only a subset of patients with suspected CAP, specifically those who also required a chest CT scan.

One study was judged to be an outlier because of nearly 100% discordance between US and chest radiography and was excluded (31). Thus, 11 studies with 939 patients were included (20–30). When the data were aggregated by meta-analysis, LUS had a median sensitivity of 95% (range, 68–100%), whereas chest radiography had a median sensitivity of 70% (range, 16–94%). The median specificity of US was 75% (range, 0–100%), whereas the median specificity of chest radiography was 55% (range, 0–94%) (Figure E2, Table E2).

Overall, the committee's certainty in the accuracy of the test characteristics (the quality of evidence) for both LUS and chest radiographs was judged to be low because of inconsistency (wide range of estimates across studies) and imprecision (confidence intervals [CIs] were wide with the ends leading to different clinical actions). The committee acknowledged the indirectness of the population described above but did not downgrade for it, because the committee concluded that it did not further diminish confidence in the estimated effects (Table E2).

Committee's discussion. Because the existing studies were indirect, inconsistent, and imprecise and lacked clinical outcome evaluations, the true clinical performance of LUS for the diagnosis of CAP is uncertain. There remains substantial uncertainty surrounding whether LUS is equivalent to chest radiography for management or which diagnostic approach for pneumonia results in the best outcomes for patients. However, our evidence synthesis suggests that LUS is likely to be at least as accurate as chest radiography in confirming a clinical suspicion of pneumonia. Thus, although we acknowledge the evidence is of low quality, we conditionally suggest that LUS is an acceptable diagnostic alternative to chest radiography when performed by clinicians and in settings with adequate expertise.

The studies included in the meta-analysis were limited to an indirect population: patients with indications for chest CT rather than all patients with clinical suspicion for CAP. One of the indications for chest CT is a negative chest radiography finding in a patient with high clinical suspicion of pneumonia. Interpreting the performance characteristics found in these studies should be done with extreme caution, because they are likely not generalizable to the broader population of patients with clinical suspicion of CAP. In practice, we might expect more similar performance characteristics between the two diagnostic tests, because a larger proportion of cases would have concordant findings between chest radiography and LUS. Thus, the accuracy of LUS compared with chest radiography in the population of patients with clinical suspicion for CAP is yet to be determined.

The skill of the ecographer and the quality of the US image are paramount to ensuring an accurate diagnosis. In contrast to traditional imaging studies performed by technicians and interpreted by radiologists, LUS can be performed as a point-of-care US application by bedside clinicians to answer a focused set of clinical questions. Clinicians must demonstrate the skills to identify the most common sonographic features of pneumonia, including consolidation (irregular marginal contour, air bronchogram, the air trapping sign), vertical artifacts (B-lines), and the presence of pleural effusion. Other important factors impacting LUS accuracy include the protocol followed, region of focus, and patient factors, such as obesity, drains, scars, wounds, and movement. Although full recommendations surrounding training are beyond the scope of this guideline, clinician skill level must be formally assessed to ensure that the quality of the images acquired matches the quality in published studies. Standard protocols must be followed and documented. LUS results should also be stored and reported within the

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Table 4. Key Criteria for Establishing Expertise in Lung Ultrasound Examinations

Factor	Requirements
Ultrasound equipment	Either a cart-based or handheld ultrasound device with a low-frequency ultrasound probe that provides adequate penetration, typically 14–16 cm in adults, is needed to assess for pneumonia.
Training	Requisite training in LUS must provide background knowledge; practice in image acquisition, optimization, and interpretation; and knowledge of clinical integration. Mastery of LUS knowledge and skills through formal assessments should be demonstrated before use in clinical practice as recommended by specialty guidelines (138–141).
Imaging protocol	A standardized protocol evaluating the superior and inferior portions of the anterior, lateral, and posterior chest wall should be used (32).
Image archive	Dynamic ultrasound images, typically 2–4-s video loops, should be recorded, labeled per local convention, and saved in a retrievable image archive.
Documentation	Documentation of the operator, indications, examination performed, and ultrasound findings of the pleura and lung parenchyma, including location of abnormalities using standard terminology, should be included as a report within the patient's medical record.
	Findings from different imaging modalities shall be compared and periodic quality assurance checks of clinicians using LUS should be performed at the same level of radiologic images. Discrepancies of imaging findings associated with negative outcomes should be reviewed for quality improvement.
Patient	Patient factors that limit LUS imaging, including obesity, drains, scars, wounds, and uncooperativeness, should be considered when choosing imaging modality.

Definition of abbreviation: LUS = lung ultrasound.

medical record with the same standards as those of radiographic images and reports to allow others to review and for longitudinal comparisons. Table 4 summarizes important criteria to ensure high-quality LUS in practice.

This recommendation has different implications for different settings and patients. *See* Table 1 for additional patient factors to consider that strengthen or weaken this recommendation. For settings in which and patients for whom chest radiography is available, LUS may serve as an alternative diagnostic tool if clinical suspicion of pneumonia is high, a chest radiograph finding is negative, and there are barriers or contraindications to a timely diagnosis with CT such as patient safety or cost. For settings in which and patients for whom chest radiography is not an option (due to either lack of radiology services, cost, or other patient concerns including radiation exposure and convenience), LUS is an important advance to clinical diagnosis, enabling the clinician to diagnose CAP more accurately. LUS also has distinct strengths and weaknesses relative to chest radiography. Compared with radiography, lung ultrasound is smaller, does not require technicians and supplies, and allows a focused visualization of the pleural space, which could be important advantages. However, LUS may not be appropriate for patients in whom it is important to visualize the entire lung or rule out additional processes that can be visualized only by radiography (Table 1).

Recommendation. For adults with suspected CAP, we suggest that LUS is an acceptable diagnostic alternative to chest radiography in settings where the appropriate expertise exists (conditional recommendation, low-quality evidence). Vote: 13 (87%) of 15 committee members voted in favor of a conditional recommendation for considering LUS as an acceptable diagnostic alternative to chest radiography.

What others are saying. Several professional and specialty societies have published clinical practice guidelines and recommendations to standardize the use of LUS for multiple conditions (32–40). International evidence-based recommendations for point-of-care LUS published in 2012 suggested the use of LUS for the diagnosis of pneumonia based on an evidence synthesis of diagnostic accuracy compared with chest radiography (32).

Research needs. Our recommendation is conditional based on low-quality evidence because of a lack of studies that have *1*) included the entire population of patients with suspected CAP and *2*) assessed the performance of LUS in clinical practice and its impact on outcomes compared with chest radiography diagnosis. There are several unanswered questions surrounding the clinical approach to pneumonia diagnosis, particularly surrounding the choice of imaging or how to interpret discordant results. Two types of studies are needed to improve the evidence supporting this recommendation: *1*) well-performed, multisite diagnostic accuracy studies that include all patients with clinical suspicion of pneumonia, ideally at diverse settings in patients with a broad range of illness severity; and *2*) randomized clinical trials that directly compare the impact of different imaging approaches to the diagnosis of pneumonia, including LUS, chest radiography, and chest CT, on management and clinical outcomes, cost, and patient and provider experience.

Question 2: Should Adults with Community-acquired Pneumonia Who Have a Positive Test Result for a Respiratory Virus Be Treated with Empiric Antibacterial Therapy?

Rationale. The decision whether to administer empiric antibacterial therapy to a patient with pneumonia who has a positive test result for a virus is difficult. The question should be interpreted not as whether to treat viruses with antibiotics (which have no effect on viral infections) but when to consider the risks and consequences of viral-bacterial coinfection. The lung compartment is difficult to sample directly, and microbiology cultures take time to grow and can be inaccurate. The important role of bacteria in deaths caused by influenza was established by Morens and colleagues (41), who found evidence for coinfecting bacteria in lung

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tissue from more than 90% of persons who died in the 1918–1919 influenza epidemic. *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Haemophilus influenzae* are the most common bacterial pathogens identified in patients with influenza virus coinfection (42). In the 1957–1958 Asian influenza outbreak, coinfection with *S. aureus* was the major cause of death (43). Although the mechanisms leading to bacterial-viral coinfection are unclear, proposed theories include viral infection first causing epithelial barrier compromise, impaired immunity, and inflammation producing enriched nutrients, providing an opportunity for bacterial overgrowth (44, 45). Because of poor sensitivity of microbiology and concern for coinfection, empiric antibiotics have historically been administered, regardless of whether a pathogen is identified. However, the widespread availability of rapid molecular assays has unearthed more viral pathogens, as well as codetection of viral with bacterial pathogens, than previously documented. Prospective studies with intensive diagnostic efforts during the initial work-up have failed to identify any etiologic agent in more than one-half of patients hospitalized for CAP (46, 47). No currently available combination of clinical, radiologic, or laboratory characteristics reliably distinguishes patients who have viral, bacterial, or viral-bacterial coinfections, making it difficult to ascertain the need for antibacterial therapy in addition to antiviral therapy if such is available (47). In deciding whether to treat a patient with CAP who has a positive test result for a respiratory virus for a possible bacterial coinfection, two important risks must be weighed:

1. Risks of missed or delayed antibiotic treatment to patients with concomitant bacterial pneumonia (adverse outcomes and death) (42, 48–52)
2. Risks of antibiotic use to individual patients (side effects, disruption of microbiome, costs) and public health (antimicrobial resistance) (53)

Evidence synthesis. Our systematic review sought studies that enrolled patients with CAP and compared antibiotics versus no antibiotics after the identification of a viral respiratory pathogen by PCR. The literature search identified 3,895 articles, but, upon full-text review of 27 articles, none met our prespecified study selection criteria (lack of comparison or outcomes; *see* the online supplement for details). The search was then broadened to seek indirect evidence. Again, no studies met our prespecified study selection criteria. Therefore, no published studies were identified to inform the guideline committee's recommendations, and the guideline committee had to make clinical recommendations on the basis of noncomparative evidence and their nonsystematic clinical observations, which constitutes very low-quality evidence.

Committee's discussion. Given the lack of studies to inform the impact of antibiotics on outcomes for patients with CAP who have a positive test result for a respiratory virus, the committee addressed the question by combining epidemiologic evidence, pathophysiologic understanding, and clinical experience. We emphasize that the following recommendations are conditional and should be individualized on the basis of clinical judgment. Individual patient factors that strengthen or weaken each recommendation are provided in Table 1.

For outpatients, we recommend not offering empiric antibacterial therapy to every outpatient with CAP who has a positive test result for viral pathogen on the basis of *1*) the lack of epidemiologic studies that enrolled outpatients and evaluated the prevalence and outcomes of viral-bacterial codetection (54), and *2*) the committee's judgment that the low risk for an undesirable outcome if antibiotics are withheld or delayed means the potential benefits of early antibacterial therapy may not exceed the risks of harmful consequences of antibiotics to individual and public health. In contrast, we recommend administering empiric antibacterial therapy to adult outpatients who have comorbidities that might place them at risk for a serious outcome if antibiotics are withheld or delayed. There was disagreement among committee members regarding which comorbidities pose sufficient risk to warrant administering antibiotics to ambulatory patients with a detected viral pathogen. Factors discussed included those that increase the risk of either bacterial infection (decreased pulmonary clearance, impaired immunity) or poor outcomes from untreated bacterial coinfection (42). Table 5 depicts the results of the committee members' votes concerning comorbidities that support antibiotic therapy for outpatients with CAP who have a positive test result for a respiratory virus.

For inpatients hospitalized for CAP who have a positive test result for a respiratory virus, we suggest prescribing empiric antibiotics on the basis of *1*) ample medical literature documenting the coexistence of bacteria in patients who have pneumonia and have a positive test result for a respiratory virus, especially influenza virus and, to a lesser extent, respiratory syncytial and other respiratory viruses (47, 55, 56); and *2*) high risk of poor outcomes with viral-bacterial coinfection (43, 48), which likely increases if antibiotics are withheld or delayed in the event of bacterial infection (54). The committee recommendation for severe CAP was strong and unanimous despite very low quality of evidence, because insufficient antibiotic therapy can result in serious adverse outcomes or death in patients with severe CAP (1, 47, 49, 50, 57). A systematic review of epidemiologic studies evaluating the etiology of pneumonia among predominantly hospitalized patients reported that in studies in which viral PCR was performed, a respiratory virus was identified in 30–40% of patients, and bacteria were detected in 25–35% of these cases (58). The studies demonstrated that codetection of viral and bacterial pathogens in CAP caused by viruses other than SARS-CoV-2 occurred in about 25–30% of patients (47, 55, 59). A separate study that evaluated all patients hospitalized for CAP found to have a viral illness reported an 18–39% rate of bacterial detection (60). Prospective studies of CAP have shown the coincidence of viral and bacterial pathogens to vary from 3% to 19% (47, 59, 61). However, in these studies, there was widespread variation in sampling rates, and investigators failed to identify any etiologic agent in 37–62% of pneumonia cases. Using specialized techniques, a study limited to the small proportion of patients who could provide a high-quality purulent sputum sample at admission showed that, in addition to detection of usual bacterial pathogens, commensal bacteria, so-called normal respiratory flora, were present in an additional 8% of cases (58). The role of bacterial coinfection with commensal respiratory flora will not be recognized using currently available techniques.

The burden and consequences of bacterial coinfection may vary by viral pathogen. Recent studies of adults hospitalized for respiratory syncytial virus pneumonia show that 12–29% (62) have bacterial coinfection. Among patients hospitalized with SARS-CoV-2 virus during

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Table 5. Comorbidities that May Warrant Antibiotic Therapy for Outpatients with Community-acquired Pneumonia Who Have a Positive Test Result for a Respiratory Virus

Comorbidity (*See Footnotes for Further Definitions and Examples*)	Percentage of Committee Members Who Voted This Condition that May Warrant Antibiotics
Greater than 50% agreement	
Chronic pulmonary disease other than asthma	82
End-stage liver disease	71
End-stage renal disease	65
Cardiovascular disease	53
Alcoholism	53
Neoplastic disease	53
Less than 50% agreement	
Neurological disease	47
Chronic liver disease	35
Malnutrition	35
Current smoker	35
Corticosteroid therapy* (<20 mg daily or <4 wk)	30
Diabetes mellitus	29
Chronic kidney disease	24
HIV* (CD4, >200)	24
Asthma	21
Rheumatological diseases* (not receiving immunosuppressants)	18
Obesity (BMI, >30 kg/m^2)	12

Definition of abbreviation: BMI = body mass index.
Conditions are ranked by the percentage of committee members who would prescribe antibiotics for patients with each condition, in descending order. Chronic pulmonary diseases other than asthma are chronic obstructive pulmonary disease, bronchiectasis, or interstitial lung disease. End-stage liver disease includes ascites, variceal hemorrhage, hepatic encephalopathy, or renal impairment. End-stage renal disease includes glomerular filtration rate <15 ml/min lasting >3 months. Solid organ transplant recipient is defined as not receiving immunosuppressive antirejection medication. Cardiovascular disease includes congestive heart failure, coronary artery disease, or poorly controlled hypertension. Alcoholism is defined as recurrent or ongoing alcohol use despite inability to fulfill obligations or despite social or interpersonal problems exacerbated by alcohol use. Neoplastic disease is defined as not receiving immunosuppressive chemotherapy. Neurological disease includes Parkinson's disease, dementia, myasthenia gravis, or amyotrophic lateral sclerosis. Chronic liver disease is defined as abnormal liver function test results, coagulopathy, or other evidence of chronic liver damage lasting >3 months. Malnutrition is defined as weight loss, BMI <18.5 kg/m^2, reduced muscle mass, or reduced food intake or assimilation. Current smoker includes cigarettes and marijuana. Corticosteroid therapy was not at immunosuppressive doses such as a cumulative dose >600 mg of prednisone. Chronic kidney disease is defined as glomerular filtration rate 15–60 ml/min, albuminuria >30 mg/24 hours, or other markers of kidney damage lasting >3 months. HIV is defined as with CD4 >200 and no AIDS-defining illness. Rheumatological diseases include rheumatoid arthritis or systemic lupus erythematosus and not receiving immunosuppressive medication. Obesity is defined as BMI >30 kg/m^2.
*Patients with solid organ transplant receiving antirejection medications, corticosteroid therapy more than 20 mg/d for 4 weeks, HIV with CD4 count <200, or rheumatological diseases and receiving immunocompromising medication should be considered immunocompromised hosts to whom the community-acquired pneumonia guidelines do not apply. Refer to References 6 and 7 for guidance on diagnosis and management of these patients.

the pandemic, a systematic review of 24 studies indicated a low rate of bacterial coinfection (3.5%) (63), although a critical analysis has questioned the results of this review (64). A European cooperative study reported a 10% rate of bacterial detection in patients intubated with COVID-19, compared with 30% among patients with influenza (65). Whether this low rate of codetection in SARS-CoV-2 will remain in the future is uncertain.

Individual patient factors that strengthen or weaken the recommendation are provided in Table 1. The committee discussed whether features from the history or laboratory studies could reliably predict the presence of bacterial infection and thus the utility of antibiotics. However, we lack any clinical or laboratory parameters that individually or collectively reduce the probability of bacterial superinfection to a level that would allow safely withholding antibiotics. Although a high white blood cell count with the presence of band forms, an elevated procalcitonin concentration, or a delayed presentation could support a potential role for bacterial coinfection, the absence of these findings is not sufficiently reliable to exclude it for two reasons. First, the ability to predict microbiology on the basis of biomarkers is poor. For example, sensitivity and specificity of procalcitonin is, at best, approximately 75–80% (66, 67), and this performance may be worse in the setting of viral infection (68). Attempts to distinguish bacterial from viral causes of pneumonia on the basis of clinical criteria have also not been successful (47, 59). Second, even if these biomarkers were predictive of microbiology results, given that microbiology tests themselves are poor at identifying true bacterial infection in the lung, they are still insufficient to predict benefit or harm of antibiotics.

Because it is currently difficult to exclude the possibility of bacterial infection, the majority of the committee advised initiating antibacterial therapy in patients whose illness severity from pneumonia is sufficient to require hospitalization. However, the patient's presentation (Table 1), including comorbid conditions, clinical features, radiographic findings, virus identified, laboratory/microbiologic results,

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and clinical response, should be considered when reassessing the indication for continued antibiotics versus early discontinuation. We recommend that when empiric antibacterial therapy is initiated, clinicians should perform daily evaluations of clinical stability and review of microbiological results to inform deescalation or early discontinuation of antibacterial therapy. For specific recommendations regarding antimicrobial therapy including specific antibiotic regimens and antivirals, please refer to prior 2019 ATS/IDSA guidelines.

Recommendations.

1. For adult outpatients without comorbidities who have clinical and imaging evidence of CAP and who have a positive test result for a respiratory virus, we suggest not prescribing empiric antibiotics because of concern for bacterial-viral coinfection (conditional recommendation, very low-quality evidence). Remark: This is a conditional recommendation because the balance between benefit and harm of empiric antibiotics will vary on the basis of clinical context (*see* Table 1). Vote: 14 (93%) of 15 committee members voted in favor of NOT prescribing antibiotics.
2. For adult outpatients with comorbidities who have clinical and imaging evidence of CAP and who have a positive test result for a respiratory virus, we suggest prescribing empiric antibiotics because of concern for bacterial-viral coinfection (conditional recommendation, very low-quality evidence). Remark: This is a conditional recommendation because the balance between benefit and harm of empiric antibiotics will vary on the basis of clinical context (*see* Table 1). Vote: 11 (73%) of 15 committee members voted in favor of prescribing antibiotics.
3. For adult inpatients with clinical and imaging evidence of nonsevere CAP who have a positive test result for a respiratory virus, we suggest prescribing empiric antibiotics (conditional recommendation, very low-quality evidence). Remark: This is a conditional recommendation because the balance between benefit and harm of empiric antibiotics will vary on the basis of clinical context (Table 1). Vote: 12 (80%) of 15 committee members voted in favor of prescribing antibiotics.
4. For adult inpatients with clinical and imaging evidence of severe CAP who have a positive test result for a respiratory virus, we recommend prescribing empiric antibiotics (conditional recommendation, very low-quality evidence). Remark: Although the committee was unanimous in making this recommendation, this is a conditional recommendation because of the absence of comparative evidence. Vote: 15 (100%) of 15 committee members voted in favor of prescribing antibiotics.

What others are saying. Prior 2019 ATS/IDSA clinical practice guidelines recommended that standard antibacterial treatment be initially prescribed for adults with clinical and radiographic evidence of CAP who have a positive test result for influenza in both the inpatient and outpatient settings, based on multiple epidemiologic studies that reported high rates of detection of bacteria. The present update diverges from this recommendation for outpatients with CAP and influenza without comorbidities on the basis of the lack of epidemiologic evidence in outpatients, low risk of harm of withholding antibacterials in this population, and risks of antibiotic overuse to public health. The ATS guideline update addressing noninfluenza respiratory viral tests recommended against routine testing of viruses (3). Given the pandemic experience, the dynamic nature of viral epidemics, increasing availability of lower-cost tests, and potential for positive viral test results to change management, this recommendation may require future review. The decision when to obtain viral tests should be left to clinical judgment informed by both individual patient factors and local epidemiology. Guidelines for managing COVID-19 during the pandemic (4, 5) recommended that antibiotics not be administered unless there is evidence for bacterial coinfection on the basis of lower rates of bacterial detection observed during the pandemic. No guidelines have addressed whether to administer antibacterial therapy in patients with CAP who have a positive test result for other respiratory viruses, such as respiratory syncytial virus, because of the concern of bacterial coinfection (1, 69–71). Recent European Respiratory Society/European Society of Intensive Care Medicine/European Society of Clinical Microbiology and Infectious Diseases/Latin American Thoracic Association (ERS/ESICM/ESCMID/ALAT) guidelines for severe CAP recommend the use of molecular diagnostic PCR to detect both bacteria and virus when available, continue to recommend empiric antimicrobial for all patients, and highlight the need for studies that elucidate the safety of discontinuing antibiotics if bacterial test results are negative (72).

Research needs. There is an immediate need to improve the quality of evidence through comparative effectiveness research, including *1*) randomized controlled studies to determine which patients with CAP benefit from or are harmed by antibiotics when a virus is detected; *2*) studies that evaluate patients on the basis of the virus identified, illness severity, patient comorbidities, and for outcomes that impact patients beyond 30-day mortality (such as return to function and antibiotic-associated side effects); *3*) studies that compare the withholding of empiric antibiotics versus initiating and discontinuing them early (within the first 24–48 h of initiation) versus standard approaches; and *4*) studies of tailored approaches based on patient factors, including severity of illness presentation, patient- and virus-related risk of bacterial infection, and microbiological and biomarker information, including novel tests such as bacterial multiplex PCR, inflammatory markers, or host transcriptional signals (73, 74). Additional research is also needed to support appropriate use and interpretation of these tests, including which patient and environmental factors should be used to consider when to obtain viral testing.

Question 3: Should Adults with Community-acquired Pneumonia Who Reach Clinical Stability Be Treated with Less than 5 Days of Antibiotics?

Rationale. The optimal duration of antibiotic treatment in CAP is unknown. Because of concerns that pathogens may develop resistance if undertreated (75), prior CAP guidelines from the 1990s recommended antibiotic durations as long as 14 days, well beyond clinical stability (76, 77). However, as our model of lung infection advances, the goals of antibiotics may no longer be to completely eradicate causative pathogens (78) but rather to reduce bacterial load with as little disruption to the microbiome as possible (79). Harms from longer antibiotic durations are increasingly observed, including side effects (80, 81), *Clostridioides difficile* infection (82, 83), acute

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kidney injury (83), disruption of normal flora (84), and emergence of antibacterial resistance (85, 86). Over the past two decades, several studies have demonstrated noninferior clinical outcomes with shorter durations of antibiotic therapy compared with longer durations (87–91). ATS/IDSA CAP guidelines in both 2007 and 2019 recommended a duration of antibiotic therapy no more than 5 days if the patient reaches clinical stability. Since these recommendations, additional clinical trials suggested that durations shorter than 5 days could be adequate for selected patients reaching clinical stability.

Evidence synthesis. The initial evidence synthesis included 13 studies of immunocompetent patients with clinical and imaging evidence of CAP that evaluated any antibiotic as long as it involved less than 5 days of treatment. This was changed to include only studies evaluating less than 5 days of effective duration so that studies of azithromycin were included only if it was administered for less than 3 days because of the pharmacokinetics of azithromycin (1 d of high-dose 2-g azithromycin microspheres are effectively 4 d in duration, and 3 d of 500-mg or 1-g azithromycin are effectively 5 d or slightly longer in antibiotic duration) (92, 93). Several studies in which azithromycin was administered for 3 days were thus removed. Our systematic review identified four relevant randomized controlled trials that compared $<$5 effective days' duration of antimicrobial therapy with $\geqslant$5 days' duration (87, 89, 94, 95). Two of the trials evaluated azithromycin in outpatients: D'Ignacio and colleagues compared 1 day of 2-g extended-release azithromycin with 7 days of 500-mg levofloxacin, and Drehobl and colleagues compared 1 day of 2-g extended-release azithromycin with 7 days of 1-g extended-release clarithromycin (94, 95). These were considered an assessment of effectively 3 days' duration of antimicrobial therapy, given the pharmacokinetics of azithromycin; four studies evaluating 3 days of azithromycin were not included. The other two trials used β-lactams and enrolled hospitalized patients. In immunocompetent nonpregnant inpatients with mild or moderate pneumonia admitted to hospital wards who had clinical improvement after a 3-day course of high-dose intravenous amoxicillin, Moussaoui and colleagues compared placebo with 5 additional days of 750-mg amoxicillin by mouth three times daily. Among immunocompetent hospitalized patients without a history of respiratory insufficiency or severe or complicated pneumonia who reached clinical stability after a 3-day course of a β-lactam antibiotic, Dinh and colleagues compared placebo with 5 additional days of 1-g/125-mg oral amoxicillin-clavulanate (87, 89) (Table E4 and Table E5). The studies used different definitions of clinical cure and had variable follow-up time periods, although the follow-up periods could be classified as either 1–2 weeks or 3–4 weeks after treatment initiation.

The guideline committee *a priori* defined three outcomes as "critical," which included mortality, treatment success/failure, and CAP complications. Out of these outcomes, only mortality and treatment success (defined by studies as clinical cure) could be estimated from the included studies. The committee also *a priori* defined five outcomes as "important," including duration of hospitalization, antibiotic-free days, patient experience, cost, and antibiotic resistance. Out of these outcomes, only one study evaluated duration of hospitalization.

The data were aggregated by meta-analysis for each outcome (Figure E5). Mortality was evaluated in only one study (Dinh and colleagues), which showed no statistically significant difference when fewer than 5 days of antibiotics were compared with 5 or more days (2.0% vs. 1.3%; risk ratio, 1.49; 95% CI, 0.25 to 8.79). One death occurred among patients treated with fewer than 5 days of antibiotics; the patient had bacteremia caused by *Staphylococcus aureus.* One death occurred among patients treated with more than 5 days of antibiotics; the patient had recurrent pneumonia. The clinical cure rate 1–2 weeks after treatment was similar among patients who received less than 5 days of antibiotics versus those who received 5 or more days (85.6% vs. 87.6%; risk ratio, 0.98; 95% CI, 0.91 to 1.05) (Figure E5 and Table E6.1).

Subgroup analyses for clinical cure rate 1–2 weeks after treatment were based on the setting and antibiotic. For the subgroup of outpatients treated with azithromycin, the clinical cure rate 1–2 weeks after treatment was similar among patients treated with less than 5 days of antibiotics compared with 5 or more days of antibiotics (87.4% vs. 91.9%; risk ratio, 0.96; 95% CI, 0.91 to 1.01) (Figure E5 and Table E6.2). Likewise, for the subgroup of inpatients treated with β-lactams, the clinical cure rate 1–2 weeks after treatment was similar among patients treated with less than 5 days of antibiotics versus those treated for 5 or more days (81.9% vs. 75.7%; risk ratio, 1.06; 95% CI, 0.90 to 1.24) (Figure E5 and Table E6.3).

Clinical cure rate 3–4 weeks after treatment was similar among patients who received less than 5 days of antibiotics versus those who received 5 or more days (81.0% vs. 82.5%; risk ratio, 0.99; 95% CI, 0.92 to 1.07) (Figure E5 and Table E6.1). For the studies evaluating azithromycin in outpatients, the clinical cure rate 3–4 weeks after treatment was similar among patients treated with less than 5 days of antibiotics versus those treated with 5 or more days (82.1% vs. 84.1%; risk ratio, 0.98; 95% CI, 0.84 to 1.13) (Figure E5 and Table E6.2). For the studies evaluating β-lactams among inpatients, the clinical cure rate 3–4 weeks after treatment was also similar among patients treated with less than 5 days of antibiotics versus those treated with 5 or more days (78.7% vs. 79.2%; risk ratio, 1.01; 95% CI, 0.92 to 1.11) (Figure E5 and Table E6.3).

Hospital length of stay was not impacted by whether subjects were treated with less than 5 days or with 5 or more days of antibiotics (mean, 6 $\pm$ 3.7 d vs. 6.3 $\pm$ 3.7 d; mean difference, $-$0.35 d; 95% CI, $-$1.17 to 0.47 d) (Figure E5 and Table E6.3). Overall, the committee's certainty in the accuracy of the estimated effects (the quality of evidence) was low (Table E6).

Committee's discussion. Our recommendation for antibiotic duration in adults with CAP who reach clinical stability varies on the basis of CAP severity and treatment setting. Table 6 defines clinical stability according to the study definitions.

For immunocompetent adult outpatients and inpatients with nonsevere CAP who reach clinical stability, we suggest treating with $<$5 days' effective duration of antibiotics (minimum of 3 d) rather than $\geqslant$5 days of antibiotics because of the four recent trials that suggested similar clinical outcomes in these groups. The pharmacokinetics of the antibiotic and the patient's renal and hepatic function must be considered to establish the number of days of treatment that are equivalent to the suggested therapeutic duration (the effective number of days), particularly for macrolides (which have a half-life of 3 d) and for patients with renal insufficiency.

We recognize that the existing studies *1*) established noninferiority but not clinical benefit of shorter durations in a select group of patients, excluding many patients with comorbidities; *2*) did not evaluate important

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Table 6. Clinical Stability Definitions*

Temperature	⩽37.8°C
Heart rate	<100 beats per minute*
Respiratory rate	<24 breaths per minute*
Arterial oxygen saturation or partial pressure	Sp_{O_2} ⩾90% or Pa_{O_2} ⩾60 mm Hg on room air* or baseline oxygen requirement†
Systolic blood pressure	⩾90 mm Hg
Mental status	Normal

Definition of abbreviation: Sp_{O_2} = oxygen saturation as measured by pulse oximetry.
The duration of antibiotics should be determined on the basis of daily assessment of clinical responses.
*All criteria needed to be met to be considered "stable" in the Dinh and colleagues study (89). Prior 2007 guidelines and the Uranga and colleagues study (88) required the patient to be afebrile plus having no more than one sign of instability and used a heart rate ⩽100 beats per minute and respiratory rate ⩽24 breaths per minute. For the el Moussaoui and colleagues study, eligibility for 3-day duration was determined by improvement of 2 or more points on a respiratory symptom scale, temperature <38°C, and ability to perform oral intake.
†Neither the Dinh and colleagues nor the el Moussaoui and colleagues study included patients with chronic respiratory insufficiency. Thus, this factor weakens this recommendation (*see* Table 1).

outcomes such as CAP-related complications or return to baseline function; and *3*) examined antibiotic selection and doses that are not considered appropriate treatment by the IDSA/ATS (azithromycin and clarithromycin are not considered adequate treatment for outpatients because of the high rate of macrolide-resistant *Streptococcus pneumoniae* in the United States; combination therapy of β-lactam plus macrolide or fluoroquinolone is strongly recommended for inpatients; and fluoroquinolone dosing for CAP is 750-mg levofloxacin or 400-mg moxifloxacin).

For outpatients, many meet clinical stability criteria upon presentation, but individual patient factors (listed in Table 1) should be considered for appropriateness, and all patients should be monitored for clinical recovery or recurrent infection. Assessing the safety of discontinuing antibiotics on Day 3 requires close follow-up, which may be difficult in some settings and patients. If prescribing short courses of antibiotics, clinicians and patients should develop an optimal plan based on individual patient preferences, discuss signs and symptoms of recovery or recurrence of infection (elevated temperature or heart rate, shortness of breath, altered mental status), and establish communication lines and contingency plans.

For inpatients with nonsevere CAP, this recommendation should be applied only to those patients who do not have additional contraindications to short courses of antibiotics and who reach clinical stability, including resolution of new oxygen needs. Table 1 lists additional patient factors to consider, such as patient comorbidities and results of inflammatory markers. Antibiotic courses should not be implemented as a set duration for all patients determined at presentation, because many patients have contraindications to shorter durations, and time to clinical stability is difficult to predict on presentation. The duration of antibiotics should be determined day by day on the basis of clinical responses. A sizable proportion (over 50%) of hospitalized patients with nonsevere CAP would not be eligible for short courses (96–99). Patients discharged home should also establish clear follow-up plans for symptoms of recurrence.

Adults with severe CAP were not evaluated in the trials we reviewed. We thus maintain our prior strong recommendation of 5 days or greater because of these patients' higher risk of disseminated infection, necrotizing or resistant organisms, and higher risk and consequences of treatment failure.

Regardless of illness severity, patients with contraindications to shorter courses, including severe chronic lung disease such as bronchiectasis, evidence of necrotizing pneumonia such as lung abscesses or empyema, or confirmed infection with a necrotizing or resistant organism such as *Staphylococcus aureus* or *Pseudomonas aeruginosa* require tailored antimicrobials according to guidance specific to these complications. In patients with low certainty of a CAP diagnosis who have an alternative diagnosis that better explains their illness, antibiotics should be discontinued. This is not a short course for pneumonia but an individualized treatment based on refined diagnosis.

Recommendations.

1. For adult outpatients with CAP who reach clinical stability, we suggest less than 5 days of antibiotics (minimum of 3-d duration) rather than 5 or more days of antibiotics (conditional recommendation, low-quality evidence). Remark: This is a conditional recommendation that requires individualization. *See* Table 1 for factors that weaken this recommendation. Vote: 15 (94%) of 16 committee members voted in favor of less than 5 days of antibiotics.
2. For adult inpatients with nonsevere CAP who reach clinical stability, we suggest less than 5 days of antibiotics (minimum of 3-d duration) rather than 5 or more days of antibiotics (conditional recommendation, low-quality evidence). Remark: This is a conditional recommendation that requires individualization. *See* Table 1 for factors that weaken this recommendation. Vote: 11 (69%) of 16 committee members voted in favor of less than 5 days of antibiotics.
3. For adult inpatients with severe CAP who reach clinical stability, we suggest 5 or more days of antibiotics rather than less than 5 days of antibiotics (strong recommendation, low-quality evidence). Remark: This recommendation is strong despite the low quality of evidence because robust evidence indicates that insufficient antibiotic therapy can result in serious adverse outcomes or death in patients with severe CAP. Note: 15 (94%) of 16 committee members voted for 5 days or more of antibiotics.

What others are saying. British Thoracic Society guidelines (2009) and National Institute for Health and Care Excellence guidelines (2015) for the management of CAP recommended a 5-day course of a single antibiotic for patients with low-severity CAP and 7–10 days' duration

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for patients with moderate or severe CAP (100, 101). However, it should be noted that these society guidelines do not endorse the same empiric strategy of antibiotics recommended by IDSA/ATS. ERS and ESCMID guidelines for the management of lower respiratory tract infections (2011) recommended antibiotics for 7 days among inpatients with nonsevere CAP (71). Consensus guidelines for the management of severe CAP issued by ERS/ESICM/ESCMID/ALAT (102) (2023) conditionally recommend that procalcitonin may be used to reduce the duration of antibiotic treatment in patients with severe CAP when the duration of antibiotic therapy was over 7 days. In the case of durations less than 5 days, the utility of inflammatory markers has not been addressed.

Research needs. Our recommendations are conditional based on low quality of evidence, and the optimal duration of therapy for patients with CAP once they reach clinical stability is still unknown. Research needed to better inform this recommendation includes clinical trials that evaluate *1*) first-line therapies; *2*) outcomes that are important to patients, such as development of complications (whether from the infection or the antibiotic treatment), long-term outcomes, antibiotic effects, length of hospitalizations, and return to function; and *3*) tailored strategies based on pathogen identification, illness severity (nonsevere vs. severe CAP), clinical response, and serial inflammatory markers.

Question 4: Should Adults Who Are Hospitalized with Community-acquired Pneumonia Be Treated with Corticosteroids?

Rationale. The host immune response to infection is an increasingly recognized factor influencing mortality and morbidity in patients with CAP. Treatments that target immunomodulation such as corticosteroids have historically had mixed results. The 2019 ATS/IDSA guideline for the management of adults with CAP previously reviewed the question whether corticosteroids should be included as part of the treatment regimen for adults with CAP. The guideline committee recommended against routine use of corticosteroids in adults with nonsevere CAP (strong recommendation, high quality of evidence) and suggested against their routine use in adults with severe CAP (conditional recommendation, moderate quality of evidence). These recommendations were based on the review of four meta-analyses of published trials, two of which reported a mortality benefit in patients with severe CAP (103, 104) and two of which did not find a benefit (105, 106). Since the publication of those guidelines, several additional trials have been published evaluating the effect of corticosteroids on mortality and other CAP outcomes, including one trial that demonstrated a significant mortality benefit when steroids were prescribed in severe CAP (107). In addition, the 2021 publication of the RECOVERY (Randomized Evaluation of COVID-19 Therapy) trial demonstrated a strong benefit of corticosteroids in patients with moderate to severe COVID-19 during the pandemic, particularly in patients who required oxygen by high-flow nasal cannula or invasive mechanical ventilation (108). These new studies and experiences add weight to a pathophysiologic mechanism of benefit of immunomodulation for select patients with pneumonia, led others to update their recommendations (102, 109), and support the need to reassess the evidence regarding use of corticosteroids in adults with CAP.

Evidence synthesis. Our literature search identified 16 relevant studies (107, 110–124). One relevant study was excluded because it was retrospective (111), leaving 15 randomized controlled trials for analysis (107, 110, 112–124). All trials enrolled inpatients but used varying definitions of CAP. Six trials evaluated hydrocortisone therapy (107, 112, 115, 119, 120, 123), and the remaining trials examined methylprednisolone (three trials) (113, 116, 122), dexamethasone (three trials) (114, 117, 124), and prednisone/prednisolone (three trials) (110, 118, 121). The duration of corticosteroids varied among trials but included 7 days (five trials) (110, 112, 119–121), 5 days or fewer (seven trials) (114, 115, 117, 118, 122–124), and longer durations (three trials) (107, 113, 116) (Table E7).

The guideline committee *a priori* defined four outcomes as "critical": mortality, treatment/clinical failure, clinical stability, and adverse drug events. The committee also *a priori* defined four outcomes as "important": symptoms, disability or return to independence/function, length of stay, and antibiotic days. Given a lack of consistent measurement of symptomatic improvement, return to function/independence, or disability across the selected trials, these outcomes were not evaluated.

When the data were aggregated by meta-analysis, corticosteroids decreased mortality (6.1% vs. 9.1%; risk ratio, 0.68; 95% CI, 0.53 to 0.86), which means that if applied to a population similar to that enrolled in the trials, it is estimated that one death would be prevented for every 34 (range, 23–78) patients who received corticosteroids (Figure E8 and Table E8.1). In patients with nonsevere CAP (117, 124), the decrease in mortality was not statistically significant (4.4% vs. 6.7%; risk ratio, 0.88; 95% CI, 0.55 to 1.41) (Figure E8 and Table E8.3). When the meta-analysis was restricted to patients with severe CAP (107, 112, 115, 116, 120, 122), the decrease in mortality was significant (9.8% vs. 15.1%; risk ratio, 0.62; 95% CI, 0.41 to 0.94), meaning that one death could be prevented for every 17 (95% CI, 11–110) patients with severe CAP who receive corticosteroids (Figure E8 and Table E8.2).

Corticosteroids also decreased the length of stay (mean difference, −1.53 d; 95% CI, −2.14 to −0.91 d) (Figure E8 and Table E8.1) (110, 112, 113–119, 121, 122, 124). The decrease in the length of stay was not statistically significant in patients with nonsevere CAP (mean difference, −0.52 d; 95% CI, −1.33 to 0.28) (Figure E8 and Table E8.3) but was significant for patients with severe CAP (mean difference, −1.06 d; 95% CI, −2.01 to −0.12) (Figure E8 and Table E8.2).

There was no significant effect on adverse events (risk ratio, 1.2; 95% CI, 0.89–1.63) (Figure E8 and Table E8.1), including the subgroups of patients with nonsevere CAP (risk ratio, 1.37; 95% CI, 0.73 to 2.43) and severe CAP (risk ratio, 1.12; 95% CI, 0.69 to 1.82) (Figure E8 and Table E8.2). Corticosteroid therapy did not demonstrate an effect on treatment failure (risk ratio, 0.83; 95% CI, 0.25 to 2.80) or time to clinical stability (mean difference, −0.45 d; 95% CI, −1.77 to 0.86 d). There was no effect on antibiotic duration (mean difference, −2.01 d; 95% CI, −4.46 to 0.45 d), including the subgroup of patients with nonsevere CAP (mean difference, −0.99; 95% CI, −3.93 to 1.96) (Table E8.1). Overall, the committee's certainty in the accuracy of the estimated effects (the quality of evidence) was low for both severe and nonsevere CAP because of inconsistency of results (Table E8).

Committee's discussion. The committee evaluated the evidence for corticosteroids in inpatient adults with nonsevere CAP and

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severe CAP (as defined by ATS criteria) separately. For adult inpatients with nonsevere CAP, the committee judged that because no significant difference was observed in mortality or other critical outcomes in pooled analyses, the undesirable effects of corticosteroids outweighed desirable effects. However, this recommendation does not obviate the need to administer corticosteroids for other indications in this group, such as chronic obstructive pulmonary disease or asthma exacerbations or suspicion for pneumocystis pneumonia.

In severe CAP, the committee judged that the desirable effects of steroids on critical outcomes, particularly mortality, outweighed the undesirable effects, predominantly hyperglycemia, and that the intervention is feasible and likely to be acceptable to most patients when considering patient preferences and values. The recommendation in favor of corticosteroids is conditional because our confidence in the quality of the evidence was low, in large part because of inconsistency of results across studies. Notably, the study by Dequin and colleagues (107) found a significant reduction in mortality, whereas the study by Meduri and colleagues (116) did not. Important differences in the Dequin and colleagues study that may have contributed to the positive findings include *1*) earlier exposure to corticosteroids from the diagnosis of severe CAP, *2*) criteria for severe CAP that focused on respiratory failure (and did not include patients with septic shock), *3*) exclusion of patients with influenza, and *4*) inclusion of more women. Although the committee endorses the ATS/IDSA definition of severe CAP as including need for either mechanical ventilation or vasopressor support (major criteria) or three or more minor criteria (1), we recognize heterogeneity within this group and note that the aggregate meta-analysis approach is limited in its ability to identify specific subgroups of patients who benefit most from corticosteroids. For example, an individual patient data meta-analysis of eight clinical trials identified elevated C-reactive protein as a predictor of corticosteroid benefit (125). Since the completion of our evidence review, the REMAP-CAP platform trial (A Randomized, Embedded, Multifactorial, Adaptive Platform Trial for Community-Acquired Pneumonia) reported results for fixed-dose hydrocortisone, which demonstrated no benefit regarding short-term mortality, although the shock-dependent arm and both dexamethasone arms are still ongoing (126). In addition, a preplanned subgroup analysis of the APROCCHSS (Activated Protein C and Corticosteroids for Human Septic Shock) trial evaluating corticosteroids in septic shock was also published after our evidence review, finding a significant benefit of hydrocortisone with fludrocortisone in those with septic shock caused by CAP but not of non-CAP causes (127), in contrast to the earlier ADRENAL (Adjunctive Corticosteroid Treatment in Critically Ill Patients with Septic Shock) study published in 2018 (128). A subsequent meta-analysis that included these trials reported a continued overall favorable effect of corticosteroids (129). The inconsistency of results further highlights the uncertainty of benefit for many patients and the need to individualize the decision to treat with corticosteroids. We eagerly await additional evidence surrounding different patient phenotypes to improve precision with CAP treatment and anticipate that this recommendation will be further refined on the basis of new evidence in the future. *See* Table 1 for additional patient characteristics that would strengthen or weaken this recommendation, including clinically available markers of inflammation that that may be useful to predict benefit versus harm.

Although the exact mechanism of the benefit of corticosteroids in these patients is unclear, the timing (early administration) and pattern of inflammatory response (elevated inflammatory markers, particularly C-reactive protein) may be important factors to consider when deciding which patients are most likely to benefit (125). This suggestion should not be applied to patients with CAP and influenza, because observational data suggest potential harm (130), and there is a lack of prospective, randomized data in this population because they were excluded from most of the trials. Currently available evidence precludes a recommendation on the type of corticosteroid and duration of exposure, although the trial with the most compelling results assigned patients to hydrocortisone 200 mg continuous intravenous infusion daily for either 4 or 7 days as determined by clinical improvement followed by tapering for a total of 8 or 14 days or discontinuation of corticosteroids at ICU discharge among those patients with rapid clinical improvement (107).

Recommendations.

1. For adult inpatients with nonsevere CAP, we recommend not administering systemic corticosteroids (strong recommendation, low quality of evidence). Remark: This recommendation is strong because, although the overall quality of evidence is low, the intent is to avoid harmful side effects such as hyperglycemia, for which there is robust evidence. Vote: 16 (100%) of 16 committee members voted in favor of not administering systemic corticosteroids.
2. For adult inpatients with severe CAP, we suggest administering systemic corticosteroids (conditional recommendation, low quality of evidence). Remark: This recommendation excludes patients with severe CAP caused by influenza pneumonia. Vote: 15 (94%) of 16 committee members voted for administering systemic corticosteroids.

What others are saying. The ERS/ESICM/ESCMID/ALAT guidelines published in 2023 suggest using systemic corticosteroids in severe CAP only if shock is present (conditional recommendation, very low quality of evidence) (102). This guideline did not include the study by Dequin and colleagues (107). The Society of Critical Care Medicine focused guideline update on corticosteroids recommends administering corticosteroids to adult patients hospitalized with severe bacterial CAP (strong recommendation, moderate certainty; "bacterial CAP" defined as probable or suspected bacteria) and makes no recommendation for administering corticosteroids for adult patients hospitalized with nonsevere CAP (109). The Surviving Sepsis Campaign recommends use of corticosteroids in patients with septic shock refractory to adequate fluid resuscitation and vasopressor support (131), as well as the recent update on management of adult patients with acute respiratory distress syndrome suggesting using corticosteroids in these patients (132). The NIH COVID-19 treatment guidelines (5) also recommended corticosteroids (specifically dexamethasone) for the treatment of COVID-19 pneumonia in hospitalized patients who required supplemental oxygen, particularly high-flow nasal cannula, noninvasive ventilation, or invasive mechanical ventilation, although the certainty of benefit in patients with CAP caused by SARS-CoV-2 outside of the pandemic may be lower. In addition, clinicians should use corticosteroids when

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deemed clinically appropriate for comorbid conditions, such as chronic obstructive pulmonary disease, asthma, and autoimmune diseases, in which corticosteroids are supported as a component of treatment. Multiple systematic reviews have also been published that, like the systematic review that informed our recommendations, reported benefits from systemic corticosteroids in patients with severe CAP (133–135).

Research needs. Three types of research are needed to help strengthen the evidence base informing the use of corticosteroids in CAP: trials that evaluate *1*) which patient features are associated with benefit, including those adequately designed to evaluate patient subgroups or tailored strategies based on sex, severity of respiratory failure/acute respiratory distress syndrome, inflammatory biomarkers, pathogen identification, or other key features subgroups yet to be identified; *2*) optimal dose, duration, type, and timing of corticosteroid treatment relative to onset of CAP; and *3*) outcomes in addition to mortality, such as time to clinical stability, treatment failure, impact on nonpulmonary complications of CAP (e.g., cardiovascular events), and long-term outcomes (e.g., symptom burden, functional status, and health-related quality of life). Patients with influenza should be included in this research, because data supporting their exclusion are limited to very low-quality observational studies in this population.

Patient Input

For all CAP recommendations, high-quality communication with patients should cover *1*) the rationale for the clinical recommendation; *2*) the degree of certainty for the recommendation; *3*) the advantages and disadvantages of treatment options, including side effects, cost, and convenience; *4*) what to expect over the course of treatment, including clear access to follow-up and contingency plans; and *5*) a pathway for communication and follow-up. Recommendations with less certainty should be accompanied by greater engagement with patients about their preferences and values.

When deciding whether to pursue LUS or chest radiography for diagnosis, discussions with patients should include convenience, accuracy, cost, and radiation exposure, as well as clinician expertise and the facility's ability to conduct, interpret, and document US results. The potential for each test to identify incidental findings should be considered. When weighing the decision regarding antibiotic use when a viral test result is positive, patients should be informed that antibiotics do not treat viruses and may have side effects but that bacteria and viruses can coexist. Less aggressive antibiotic therapy (no treatment or short courses) should be coupled with more aggressive monitoring and follow-up, including a clear and feasible contingency plan if a patient's condition does not improve or a patient experiences side effects. Clear definitions of clinical stability and antibiotic side effects should be communicated to patients. When considering corticosteroids, clinicians should provide realistic expectations, including uncertainty about treatment effects for any individual patient and risks of short-term versus chronic use.

Clinicians should use common language and patient information documents to explain medical concepts and adopt a tailored approach to communication based on the patient's severity of illness, ability or preference to engage in communication or shared decision making, and degree of certainty of the benefit of recommendations. Documents that provide patient-friendly explanations of pneumonia should be used to support communication and are available through the ATS (136, 137).

Conclusions

This document addresses four practice areas pertaining to the management of patients with CAP. These areas were selected by the committee because of their clinical relevance and the potential influence of recent literature on the existing standard of care.

For the purpose of diagnosing pneumonia, the use of LUS is regarded as equivalent to chest radiography, provided there is sufficient clinical expertise and infrastructure available. Concerning the use of antibacterial therapy for patients diagnosed with a respiratory virus, the suggestion is to withhold antibacterial therapy only in outpatients who do not have coexisting medical conditions that put them at risk of severe outcomes. Addressing the optimal duration of antibiotic therapy, $<$5 days of treatment is regarded as acceptable (minimum of 3-d duration), except in case of severe CAP or pneumonia caused by necrotizing or resistant organisms, such as *S. aureus* or *P. aeruginosa*. Last, the use of systemic corticosteroids is endorsed solely for a subgroup of patients experiencing severe CAP without influenza virus infection.

However, practitioners must acknowledge that most recommendations presented in this document are based on low-quality evidence or have low or very low certainty of effects. This implies that new studies are likely to have an important influence on the estimate of the effect and that the true effect might be substantially different from the estimated effect. We encourage research efforts to improve the evidence surrounding pneumonia care, particularly by conducting studies that evaluate patient-oriented outcomes in the areas of diagnosis, individualize antimicrobial treatments and host-directed therapies, and also evaluate the relationships between CAP management of individual patients and public health outcomes such as antimicrobial resistance and infection transmission.

Given the potential impact of future research on our current recommendations, it is crucial for physicians to thoroughly assess patients when implementing a clinical approach on the basis of these recommendations and to individualize their management according to patients' risks and clinical responses. We encourage a nuanced clinical approach to pneumonia care that acknowledges the complexity of lung disease and uncertainty in the evidence base. ■

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